Thermal Conductivity of Aqueous Solutions of Sodium Hydroxide

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Information on thermal conductivity of liquid solutions is essential for designing heat exchangers, modeling natural hydrothermal processes and solving problems of directed synthesis of crystals. The experimental study of thermal conductivity of aqueous sodium hydroxide meets the above requirement. Presented are results of studying aqueous solutions of sodium hydroxide in the temperature range of 293-420 K and at pressures of 0.1-20 MPa, and for concentrations 0-20% mass fraction of sodium hydroxide. The stationary method of a flat horizontal layer was used to measure the conductivity of aggressive media. A new device made from stainless steel was designed for studying the conductivity of aqueous solutions of sodium hydroxide. In the device all the heat produced by the heater is directed downwards through the layer under investigation which is located in a cell made of corrosion-resistant materials. The cell consists of two metal discs of stainless steel fitted with thermocouples T and dT. Between the discs is located a sample of liquid. While measuring thermal conductivity, the investigated substance is wholly contained in the clearance between the hot and cold plates and the dam. A strict estimate of the conductivity measurement error is given, with maximum error being ±1%. All available empirical data on these systems are analyzed. Temperature and concentration dependencies of the conductivity of the solutions are considered. The conductivity decrease with rising concentration is explained by solution structure as well as by hydration and solvation. Formulas for thermal conductivity of aqueous solutions of non-organic matter are critically assessed. An important implication of the results obtained is further improvement of devices for studying high - temperature solutions and contribution to the theory of solutions.